

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

CLAIMS LISTING (Pending claims 1-27, 28-41)

Claim 1 (Currently Amended): An apparatus for reordering sequence indicated information units ~~into proper sequence~~, comprising:

(a) a double-back shifter having plural storage devices, the shifter being for receiving and simultaneously storing a plurality of sequence indicated information units in corresponding ones of its storage devices, where the received units can be initially organized logically and upon receipt in an initial sequential order other than a proper order defined by respective sequence indicators received with and included in the received information units; and

(b) at least one a first test-and-reshuffle circuit coupled to first and second unit storage devices of said double-back shifter for testing the respective sequence indicators of valid information units, if any, stored in the first and second storage devices for proper relative order, and for reshuffling at least the relative logical order of the tested units within the double-back shifter if said testing shows the tested information units to be out of proper relative sequential order, said testing and reshuffling being repeatable for further information units that next shift into at least one of the first and second unit storage devices so that after being reshuffled, received but out of order information units can emerge to repetitively compare, reorder and shift said sequence indicated information units so as to be in proper relative sequence when finally shifted out of said double-back shifter.

Claim 2 (Currently Amended): The apparatus according to Claim 1, wherein the unit storage devices of said double-back shifter comprises: are interconnected to define:

(a.1) a first plurality of storage devices ~~units~~ configured to shift ~~contents~~ information units contained therein from one to another in a first direction; ~~and individually capable of storing a sequence indicated information unit;~~ and

(a.2) a second plurality of storage devices ~~units~~ configured to shift ~~contents~~ information units contained therein from one to another in a second direction opposite to said first direction, said second plurality of storage devices being units individually capable of

~~storing a sequence indicated information unit and~~ coupled to said first plurality of storage ~~devices units~~ such that a last one of said first plurality of storage ~~devices units~~ shifts its contents into a first one of said second plurality of storage ~~devices units~~.

Claim 3 (Currently Amended): The apparatus according to Claim 1, wherein

(b.1) said at least ~~first one test-and-reshuffle~~ circuit repetitively compares sequence indicators included in sequence indicated information units stored in at least said first and second storage devices sets of corresponding storage units of said double-back shifter, and in response, selectively reorders sequence indicated information units stored in associated ones of the storage devices units of said sets of the double-back shifter according to said comparisons.

Claim 4 (Currently Amended): The apparatus according to Claim 3, wherein

(a.1a) one or more storage devices provided units in a first shifting order of said first plurality of serially coupled storage ~~devices units~~ are operatively paired by the first test-and-reshuffle circuit and for comparison and/or cross-shuffling of contents with one or more storage devices units provided in a reverse shifting order of said second plurality of serially coupled storage ~~devices units to be included in said sets of corresponding storage units of said double-back shifter.~~

Claim 5 (Currently Amended): The apparatus according to Claim 4, wherein

said at least ~~one first test-and-reshuffle~~ circuit is configured to perform a single column, double shift mode of operation wherein information units that are to be cross-tested over one testing column for proper relative order to one another when in that testing column are shifted at different times through said first and second pluralities of serially coupled storage devices and into that one testing column.

Claim 6 (Currently Amended): The apparatus according to Claim 4, wherein

said at least ~~one first test-and-reshuffle~~ circuit is configured to perform a multicolumn mode of operation wherein at least one information unit that is to be cross-tested for proper relative order to at least one other unit, resides in a different testing column than that of the other unit at the time of cross-testing.

Claim 7 (Currently Amended): The apparatus according to Claim 4, wherein said at least ~~one~~ first test-and-reshuffle circuit is configured to perform a single shift mode of operation wherein information units that are to be cross-tested over one testing column for proper relative order to one another when in that testing column are shifted at essentially same times into that one testing column.

Claim 8 (Currently Amended): The apparatus according to Claim 1, wherein said received information units include corresponding sequence indicators for corresponding SONET payloads transmitted from at least one source module and through a switch fabric to a destination module, where the destination module includes ~~including~~ said double-back shifter ~~through a switch fabric from at least one source.~~

Claim 9 (Currently Amended): The apparatus according to Claim 8, wherein said at least one source module, said destination module and said switch fabric are distributed in a multi-shelf system.

Claim 10 (Currently Amended): The apparatus according to Claim 8, wherein said received information units include corresponding sequence indicators for corresponding SONET payloads transmitted from at least two different source modules and said sequence indicated information units include source-identifying indicators ~~indicating~~ identifying the source modules of their respective ~~sources of received~~ SONET payloads, and said at least ~~one~~ first test-and-reshuffle circuit only cross-tests for purpose of possible reordering, the sequence indicators of ~~compares and reorders sequence indicated~~ information units having source-identifying indicators indicating a same source.

Claim 11 (Original): The apparatus according to Claim 8, wherein said switch fabric includes a plurality of switch slices.

Claim 12 (Cancelled).

Claim 13 (Currently Amended): The apparatus according to claim 11, wherein ~~a length of~~ said double-back shifter includes a first number of said plural storage devices, which first number is greater than a second number of switch slices that can be

transmitting to the destination module at substantially the same time, the difference between the first and second numbers being a function of ~~is determined from the number of said plurality of switch slices and~~ a skew between best and worst case transit times for sequence indicated information units transmitted to said destination at substantially the same time by way of said second number ~~from said plurality of switch slices.~~

Claim 14 (Currently Amended): The apparatus according to Claim 11, further comprising:

a plurality of path buffers included in said destination module and individually configured to receive SONET payloads transmitted from a corresponding one of said plurality of switch slices; and

a staging shifter including a plurality of staging storage units individually corresponding to a respective one of said plurality of path buffers so that sequence indicated information units of received SONET payloads ~~are~~ can be periodically loaded into said plurality of staging storage units at a first cell transfer rate and shifted into said double-back shifter at a different rate before a next loading of received SONET payloads begins.

Claim 15 (Currently Amended): The apparatus according to claim 14, wherein said cell transfer rate is equivalent to a rate that a SONET payload is transmitted from a source module in said switch fabric to said destination module.

Claim 16 (Currently Amended): The apparatus according to Claim 14, wherein said sequence indicated information units individually each further includes a payload location pointer pointing to a location where associated payload data is stored .

Claim 17 (Currently Amended): The apparatus according to Claim 14, wherein said sequence indicated information units individually further each includes a valid entry indicator, and said at least ~~one~~ first test-and-reshuffle circuit only compares for purpose of possible reordering, ~~and reorders~~ sequence indicated information units having valid entry indicators indicating valid entries.

Claim 18 (Currently Amended): A method for reordering sequence indicated information units into proper sequence, comprising:

(a) storing sequence indicated information units in a double-back shifter;
(b) while the information units remain within the double-back shifter, repetitively comparing, reordering and shifting the sequence indicated information units within the in-a double-back shifter so as to cause the information units to be in proper indicated sequence when shifted out of said double-back shifter.

Claim 19 (Currently Amended): The method according to Claim 18, wherein:

(a.1) said double-back shifter includes an upper row having plural storage positions and a lower row having plural storage positions; and

said repetitively comparing, reordering and shifting comprises:

(b.1) ~~(a)~~ shifting data through the upper and lower top and bottom rows of said double-back shifter so as to shift at least one new sequence indicated information unit into at least one vacated position in said upper top row, shift at least one sequence indicated information unit from said upper top row to said lower bottom row, and shift at least one sequence indicated information unit out of said lower bottom row that is in proper sequence relative to all other earlier-held and currently stored sequence indicated information units in said double-back shifter that originated from a same data source;

(b.2) comparing sequence indicators of said sequence indicated information units residing in corresponding positions of said upper top and said lower bottom rows of said double-back shifter, and reordering sequence indicated information units in associated positions of said upper top and said lower bottom rows according to said comparisons; and

(b.3) ~~(e)~~ repeating said steps (b.1) and (b.2) so as (a) to (e) to process an incoming stream of sequence indicated information units arriving from one or more data sources.

Claim 20 (Currently Amended): The method according to Claim 19, wherein

(b.1a) said shifting comprises shifting each of said upper and lower top and bottom rows of said double-back shifter one position at a time.

Claim 21 (Currently Amended): The method according to Claim 19, wherein

(b.1a) said shifting comprises shifting each of said upper and lower top and bottom rows of said double-back shifter more than one position at a time.

Claim 22 (Currently Amended): The method according to Claim 18, wherein said repetitively comparing, reordering and shifting comprises:

(b.1) ~~(a)~~ shifting sequence indicated information units in a lower ~~bottom~~ row of said double-back shifter, and shifting at least one sequence indicated information unit out of said lower ~~bottom~~ row in proper sequence relative to all other earlier-held and currently stored sequence indicated information units in said double-back shifter that originated from a same data source;

(b.2) comparing sequence indicated information units stored in one or more ~~corresponding~~ positions of ~~a~~ the upper ~~top~~ row of said double-back shifter and against ~~sequence indicated information units stored in one or more positions of the lower~~ ~~said-bottom~~ row of said double-back shifter, and reordering said compared ones of the sequence indicated information units in said double-back shifter according to sequence indicators included in said compared sequence indicated information units;

(b.3) ~~(e)~~ shifting said sequence indicated information units in said upper ~~top~~ row of said double-back shifter, shifting in at least one new sequence indicated information unit into at least one vacated position in said upper ~~top~~ row, and shifting at least one sequence indicated information unit from said upper ~~top~~ row to said lower ~~bottom~~ row; and

~~(d) comparing sequence indicated information units stored in corresponding positions of a top row of said double-back shifter and said bottom row of said double-back shifter, and reordering said sequence indicated information units in said double-back shifter according to sequence indicators included in said compared sequence indicated information units; and~~

(b.4) ~~(e)~~ repeating said steps (b.1) to (b.3) ~~(a) to (e)~~ to thereby process an incoming stream of sequence indicated information units.

Claim 23 (Currently Amended): The method according to Claim 22, wherein said shiftings of steps (b.1) and (b.3) ~~(a) and (e)~~ respectively comprise shifting said ~~bottom and top~~ upper and lower rows of said double-back shifter one position at a time.

Claim 24 (Currently Amended): The method according to Claim 22, wherein said shiftings of steps (b.1) and (b.3) ~~(a) and (e)~~ respectively comprise shifting said ~~bottom and top~~ upper and lower rows of said double-back shifter more than one position at a time.

Claim 25 (Currently Amended): The method according to Claim 18, wherein the doubleback shifter includes an upper row for receiving new data and a lower row for storing older data, the method further comprising:

receiving SONET payloads transmitted through a distributed switch fabric-from at least one of plural sources a source; and

shifting at least one new sequence indicated information unit of said SONET received payloads into said double-back shifter upon each shift of said upper ~~top~~ row of said double-back shifter.

Claim 26 (Original): The method according to Claim 25, wherein said repetitively comparing, reordering and shifting comprises comparing and reordering sequence indicated information units having source indicators indicating a same source.

Claim 27 (Original): The method according to Claim 25, wherein said repetitively comparing, reordering and shifting

comprises comparing and reordering sequence indicated information units having valid entry indicators indicating valid entries.

Claim 28 (New): A data reordering mechanism comprising:

(a) a plurality of data storage units each for storing at least a corresponding, proper sequence indicator of a correspondingly received one of plural data payloads that were received in a given time period, but not necessarily received during the given time period in an order defined by their respective, proper sequence indicators, the plurality of data storage units defining part of a shifter through which the stored sequence indicators can be serially shifted; and

(b) a plurality of test-and-reshuffle circuits each coupled at least to a corresponding two different data storage units within the shifter and each operative to cross-test valid sequence indicators respectively stored in the corresponding at least two data storage units against one another, said cross-testing including testing the relative logical sequence indicated by the respectively stored sequence indicators against the relative physical storage sequence that the tested sequence indicators have within the shifter to thereby determine if the relative physical storage sequence properly comports with the indicated, relative logical sequence of the cross-tested valid sequence indicators,

(b.1) where upon determining that an improper relative physical storage sequence is present between two or more of its correspondingly cross-tested sequence indicators, each test-and-reshuffle circuit reshuffles the relative physical storage sequence within the shifter of its tested and improperly located sequence indicators, and reshuffles the relative physical storage sequence within the shifter of payload data and/or other payload related data stored in association with the improperly located sequence indicators so as to bring the relative physical storage sequence of the improperly located sequence indicators and their associated payload data or payload related data into better compliance with the relative logical sequence indicated by the respectively stored and cross-tested sequence indicators.

Claim 29 (New): The data reordering mechanism of Claim 28 wherein:

(b.1a) at least one of said test-and-reshuffle circuits reshuffles the relative physical storage sequence within the shifter of at least two of its tested and improperly located sequence indicators by cross-swapping the locations of storage within the shifter of the at least two improperly located sequence indicators.

Claim 30 (New): The data reordering mechanism of Claim 28 wherein:

(b.1a) at least two of said test-and-reshuffle circuits concurrently cross-test valid sequence indicators respectively stored in the corresponding data storage units of the corresponding at least two test-and-reshuffle circuits.

Claim 31 (New): The data reordering mechanism of Claim 30 wherein the number of test-and-reshuffle circuits that concurrently cross-test valid sequence indicators is greater than four.

Claim 32 (New): The data reordering mechanism of Claim 28 wherein:

(a.1) said shifter is divisible into at least first and second shifting rows, the first shifting row comprising a corresponding first set of said data storage units, the second shifting row comprising a corresponding second and mutually exclusive set of said data storage units, where for nonshuffled serial shifting of data about the shifter, the first shifting row receives respective ones of shifted sequence indicators before the second shifting row has the same respective sequence indicators shifted into it; and

(b.1a) at least two of said test-and-reshuffle circuits each cross-tests valid sequence indicators respectively stored in the first and second shifting rows.

Claim 33 (New): The data reordering mechanism of Claim 32 wherein the number of test-and-reshuffle circuits that each cross-test a valid sequence indicator stored in the first shifting row against one or more valid sequence indicators stored in the second shifting row is greater than four.

Claim 34 (New): The data reordering mechanism of Claim 32 wherein:

(a.2) data can be shifted by the second shifting row independently of whether data is being concurrently shifted by the first shifting row.

Claim 35 (New): A data reordering method comprising:

(a) storing in a plurality of data storage units, at least a plurality of corresponding, proper sequence indicators of correspondingly received ones of plural data payloads that were received in a given time period, but not necessarily received during the given time period in an order defined by their respective, proper sequence indicators, the plurality of data storage units defining part of a shifter through which the stored sequence indicators can be serially shifted; and

(b) using a plurality of test-and-reshuffle circuits, each coupled to a corresponding at least two different data storage units within the shifter, for cross-testing valid sequence indicators respectively stored in the corresponding at least two data storage units against one another, said cross-testing including testing the relative logical sequence indicated by the respectively stored sequence indicators against the relative physical storage sequence that the tested sequence indicators have within the shifter to determine if the relative physical storage sequence properly comports with the indicated, relative logical sequence of the cross-tested valid sequence indicators,

(b.1) upon determining that an improper relative physical storage sequence is present between two or more of its correspondingly cross-tested sequence indicators, reshuffling the relative physical storage sequence within the shifter of the tested and improperly located sequence indicators so as to bring the relative physical storage sequence of the improperly located sequence indicators into better compliance with the relative logical sequence indicated by the respectively stored sequence indicators.

Claim 36 (New): The data reordering method of Claim 35 and further comprising:

(b.2) upon determining that an improper relative physical storage sequence is present between two or more of its correspondingly cross-tested sequence indicators, reshuffling the relative physical storage sequence within the shifter of payload data and/or other payload related data stored in association with the improperly located sequence indicators so as to bring the relative physical storage sequence of the improperly located sequence indicators and their associated payload data or payload related data into better compliance with the relative logical sequence indicated by the respectively stored sequence indicators.

Claim 37 (New): The data reordering method of Claim 35 wherein:

(b.2) during said using, two or more of said plurality of test-and-reshuffle circuits concurrently cross-test their respective and valid sequence indicators.

Claim 38 (New): The data reordering method of Claim 37 wherein:

(b.3) during said using, two or more of said plurality of test-and-reshuffle circuits concurrently reshuffle their respective and valid sequence indicators.

Claim 39 (New): The data reordering method of Claim 35 wherein:

(b.2) said using includes determining if valid sequence indicators respectively stored in the corresponding at least two data storage units are from a same source of sequential data and of not reshuffling such sequence indicators if not from the same source.

Claim 40 (New): The data reordering method of Claim 35 wherein:

(b.2) said using includes shifting the plurality of corresponding, sequence indicators through the shifter so that for a given received burst of sequence indicators, each sequence indicator will have been cross-tested against all the others of the sequence indicators in the received burst.

Claim 41 (New): The data reordering method of Claim 35 wherein said shifter has at least first and second independent shift rows, the first being serially coupled to the second, and

(b.2) said using includes shifting part of the plurality of corresponding, sequence indicators through the first shift row while not shifting sequence indicators stored in the second shift row.
